

Claims

- [c1] 1. A magazine-based data cartridge library comprising:
- a frame;
 - a shelf system, operatively attached to said frame, for supporting at least two data cartridge magazines and comprising at least one shelf;
 - a drive that is operatively attached to said frame;
 - a cartridge transport device, operatively attached to said frame, for moving a data cartridge between a data cartridge magazine and said drive;
 - a magazine picker for displacing a data cartridge magazine towards and away from said shelf; and
 - an elevator for moving said magazine picker;
- wherein said magazine picker comprises:
- a magazine support; and
 - means for transporting a data cartridge magazine between said magazine support and a shelf of said shelf system;
- wherein during transporting of a data cartridge magazine between said magazine support and a shelf said shelf system, said magazine support remains in substantially the same position.
- [c2] 2. A magazine-based data cartridge library, as claimed in claim 1, wherein:
- said cartridge transport device comprises said elevator.

- [c3] 3. A magazine-based data cartridge library, as claimed in claim 1, further comprising:
an entry/exit port for conveying a data cartridge magazine between an environment that is exterior to a space defined by said frame and an entry/exit space that is interior to said space defined by said frame;
wherein said entry/exit space is accessible to said magazine transport device.
- [c4] 4. A magazine-based data cartridge library, as claimed in claim 1, wherein:
said magazine support comprises a pair of support rails for engaging a data cartridge magazine.
- [c5] 5. A magazine-based data cartridge library, as claimed in claim 4, wherein:
said means for transporting is located in a space between said pair of support rails.
- [c6] 6. A magazine-based data cartridge library, as claimed in claim 4, wherein:
said pair of support rails are adapted to engage a pair of data cartridge magazine rails.
- [c7] 7. A magazine-based data cartridge library, as claimed in claim 1, wherein:
said means for transporting comprises:

means for engaging a data cartridge magazine; and
means for moving said means for engaging.

[c8] 8. A magazine-based data cartridge library, as claimed in claim 7, wherein:
said means for engaging comprises:
a member with a surface for contacting a data cartridge magazine;
an actuator for selectively providing a motive force for moving said member so that said surface moves into and out of position to contact a data cartridge magazine; and
a linkage that constrains said member to rotate about an axis.

[c9] 9. A magazine-based data cartridge library, as claimed in claim 8, wherein:
said actuator comprises a rotational actuator that provides a rotational motive force.

[c10] 10. A magazine-based data cartridge library, as claimed in claim 9, wherein:
said rotational actuator comprises an electric motor.

[c11] 11. A magazine-based data cartridge library, as claimed in claim 7, wherein:
said means for engaging comprises:
a member with a first surface for contacting a data cartridge magazine and a second surface for contacting a data cartridge

magazine that is separated from said first surface;
an actuator for selectively providing a motive force for moving
said member so that said first and second surfaces move into
and out of position to contact a data cartridge magazine; and
a linkage that constrains said member to rotate about an axis.

[c12] 12. A magazine-based data cartridge library, as claimed in
claim 11, wherein:
said member extends from a first terminal end to a second
terminal end;
said axis is located between said first and second terminal
ends; and
said first and second surfaces are located between said axis
and said first terminal end.

[c13] 13. A magazine-based data cartridge library, as claimed in
claim 11, wherein:
said member extends from a first terminal end to a second
terminal end;
said axis is located between said first and second terminal
ends;
said first surface is located between said axis and said first
terminal end; and
said second surface is located between said axis and said
second terminal end.

[c14] 14. A magazine-based data cartridge library, as claimed in

claim 13, wherein:

said first surface comprises a third surface for contacting a data cartridge magazine and a fourth surface for contacting a data cartridge magazine that is separate from said third surface.

[c15] 15. A magazine-based data cartridge library, as claimed in claim 14, wherein:

said second surface comprises a fifth surface for contacting a data cartridge magazine and a sixth surface for contacting a data cartridge magazine that is separate from said fifth surface.

[c16] 16. A magazine-based data cartridge library, as claimed in claim 11, wherein:

said actuator comprises a rotational actuator that provides a rotational motive force.

[c17] 17. A magazine-based data cartridge library, as claimed in claim 16, wherein:

said rotational actuator comprises an electric motor.

[c18] 18. A magazine-based data cartridge library, as claimed in claim 7, wherein:

said means for engaging comprises:

a member with a surface for contacting a data cartridge magazine;

an actuator for selectively providing a motive force for moving said member so that said surface moves into and out of position to contact a data cartridge magazine; and a linkage that constrains said member to move linearly.

- [c19] 19. A magazine-based data cartridge library, as claimed in claim 18, wherein:
said actuator comprises a linear actuator that provide a linear motive force.
- [c20] 20. A magazine-based data cartridge library, as claimed in claim 19, wherein:
said linear actuator comprises a solenoid.
- [c21] 21. A magazine-based data cartridge library, as claimed in claim 7, wherein:
said means for engaging comprises a belt; and
said means for moving comprises an electric motor for rotating said belt.
- [c22] 22. A magazine-based data cartridge library, as claimed in claim 21, wherein:
said belt comprises a surface for engaging a surface of a data cartridge magazine.
- [c23] 23. A magazine-based data cartridge library, as claimed in claim 7, wherein:
said means for moving comprises an electrical motor.

- [c24] 24. A magazine-based data cartridge library, as claimed in claim 7, wherein:
said means for moving comprises a solenoid.
- [c25] 25. A magazine-based data cartridge library, as claimed in claim 7, wherein:
said means for moving comprises a lead screw.
- [c26] 26. A magazine-based data cartridge library, as claimed in claim 7, wherein:
said means for moving comprises a belt-and-pulley system.
- [c27] 27. A magazine-based data cartridge library, as claimed in claim 7, wherein:
said means for moving comprises means for linearly translating said means for engaging.
- [c28] 28. A magazine-based data cartridge library, as claimed in claim 7, wherein:
said means for transporting comprises means for sensing when said means for engaging has engaged a data cartridge magazine.
- [c29] 29. A magazine-based data cartridge library, as claimed in claim 28, wherein:
said means for sensing comprises an optical sensor.
- [c30] 30. A magazine-based data cartridge library, as claimed in

claim 8, wherein:

said means for engaging comprises a force limiter that is located between said actuator and said member.

[c31] 31. A magazine-based data cartridge library, as claimed in claim 30, wherein:

said force limiter comprises a spring.

[c32] 32. A magazine-based data cartridge library, as claimed in claim 30, wherein:

said force limiter comprises a first spring and a second spring.

[c33] 33. With respect to a magazine-based data cartridge library having a shelf for holding a data cartridge magazine that has a plurality of slots with each slot capable of holding a data cartridge, a method for moving a data cartridge magazine relative to the shelf comprising:

providing a member for engaging a data cartridge magazine;

first causing said member to engage a data cartridge magazine that is associated with a shelf;

first displacing, following said step of first causing, said member away from said shelf to displace a first point on said data cartridge magazine a first distance away from a second point on said shelf;

disengaging, following said step of first displacing, said member from said data cartridge magazine;

second displacing, following said step of disengaging, said

member towards said shelf;
second causing, following said step of second displacing, said member to engage said data cartridge magazine; and
third displacing, following said step of second causing, said member away from said shelf to displace said first point on said data cartridge magazine a second distance away from said second point on said shelf that is greater than said first distance.

[c34] 34. A method, as claimed in claim 33, wherein:
said step of first causing comprises rotating said member so that said member is oriented to engage said data cartridge magazine.

[c35] 35. A method, as claimed in claim 33, wherein:
said step of first causing comprises linearly translating said member so that said member is oriented to engage said data cartridge magazine.

[c36] 36. A method, as claimed in claim 33, wherein:
said step of first causing comprises:
first moving said member from a first position at which said member is unable to engage said data cartridge magazine to a second position at which said member is able to engage said data cartridge magazine; and
second moving said member so that said member is oriented to engage said data cartridge magazine.

- [c37] 37. A method, as claimed in claim 36, wherein:
said step of first moving occurs before said step of second moving.
- [c38] 38. A method, as claimed in claim 36, wherein:
said step of first moving occurs after said step of second moving.
- [c39] 39. A method, as claimed in claim 36, wherein:
said steps of first moving and second moving occur during overlapping time periods.
- [c40] 40. A method, as claimed in claim 33, wherein:
said step of first displacing comprises moving said member such that a portion of said data cartridge magazine remains associated with said shelf.
- [c41] 41. A method, as claimed in claim 33, wherein:
said step of first displacing comprises moving said member such that a portion of said data cartridge magazine that was previously associated with said shelf is no longer associated with said shelf.
- [c42] 42. A method, as claimed in claim 33, wherein:
said step of first displacing comprises moving said member such that said data cartridge magazine is not in a stable position with respect to said shelf regardless of the number and location of data cartridges in said data cartridge

magazine.

- [c43] 43. A method, as claimed in claim 33, wherein:
said step of first displacing comprises linearly translating said member.
- [c44] 44. A method, as claimed in claim 33, wherein:
said step of first displacing comprises linearly translating said data cartridge magazine.
- [c45] 45. A method, as claimed in claim 33, wherein:
said step of first displacing comprises pulling said member away from said shelf, wherein a force applying element that is operatively attached to said member is located ahead of a portion of said member that is in engagement with said data cartridge magazine with respect to the direction of displacement.
- [c46] 46. A method, as claimed in claim 33, wherein:
said step of disengaging comprises rotating said member so that said member is oriented to not engage said data cartridge magazine.
- [c47] 47. A method, as claimed in claim 33, wherein:
said step of disengaging comprises linearly translating said member so that said member is oriented to not engage said data cartridge magazine.

- [c48] 48. A method, as claimed in claim 33, wherein:
said step of second displacing comprises linearly moving said member towards said shelf.
- [c49] 49. A method, as claimed in claim 33, wherein:
said step of second causing comprises rotating said member so that said member is oriented to engage said data cartridge magazine.
- [c50] 50. A method, as claimed in claim 33, wherein:
said step of second causing comprises linearly translating said member so that said member is oriented to engage said data cartridge magazine.
- [c51] 51. A method, as claimed in claim 33, wherein:
said step of third displacing comprises moving said member such that there is substantially no association between said data cartridge magazine and said shelf.
- [c52] 52. A method, as claimed in claim 33, wherein:
said step of third displacing comprises moving said member such that all of the slots of said data cartridge magazine are not located in the space occupied by all of the slots when said data cartridge magazine was located on said shelf prior to said step of first causing.
- [c53] 53. A method, as claimed in claim 33, wherein:
said step of third displacing comprises linearly translating said

member.

- [c54] 54. A method, as claimed in claim 33, wherein:
said step of third displacing comprises linearly translating said data cartridge magazine.
- [c55] 55. A method, as claimed in claim 33, wherein:
said step of third displacing comprises pushing said member away from said shelf, wherein a force applying element that is operatively attached to said member is located behind a portion of said member that is in engagement with said data cartridge magazine with respect to the direction of displacement.
- [c56] 56. A method, as claimed in claim 33, wherein:
during said step of first causing, said member engages a first portion of said data cartridge magazine; and
during said step of second causing, said member engages said first portion of said data cartridge magazine.
- [c57] 57. A method, as claimed in claim 33, wherein:
during said step of first causing, said member engages a first portion of said data cartridge magazine; and
during said step of second causing, said member engages a second portion of said data cartridge magazine that is separated from said first portion of said data cartridge magazine.

- [c58] 58. A method, as claimed in claim 33, wherein:
said shelf is a moveable shelf that is associated with an
entry/exit port of the magazine-based data cartridge library.
- [c59] 59. A method, as claimed in claim 33, further comprising:
fourth displacing, following said step of third displacing, said
data cartridge magazine towards said shelf.
- [c60] 60. A method, as claimed in claim 59, wherein:
said step of fourth displacing comprises:
fifth displacing said data cartridge magazine towards said
shelf; and
sixth displacing, after said step of fifth displacing and after the
expiration of a an amount of time during which no displace of
said data cartridge magazine occurs, said data cartridge
magazine towards said shelf.
- [c61] 61. With respect to a magazine-based data cartridge library
having a shelf for holding a data cartridge magazine that has a
plurality of slots with each slot capable of holding a data
cartridge, a method for moving a data cartridge magazine
relative to the shelf comprising:
providing a support structure for holding a data cartridge
magazine;
providing a member for engaging a data cartridge magazine;
positioning said support structure at a location adjacent to a
shelf on which a data cartridge magazine that is to be moved

is located;

causing said member to engage said data cartridge magazine that is associated with said shelf; and

displacing, following said step of causing, said member away from said shelf to displace said data cartridge magazine away from said shelf and such that at least a portion of said data cartridge magazine is held by said support structure.

[c62] 62. A method, as claimed in claim 61, wherein:
said step of positioning occurs before said step of causing.

[c63] 63. A method, as claimed in claim 61, wherein:
said step of causing comprises rotating said member so that said member is oriented to engage said data cartridge magazine.

[c64] 64. A method, as claimed in claim 61, wherein:
said step of causing comprises linearly translating said member so that member is oriented to engage said data cartridge magazine.

[c65] 65. A method, as claimed in claim 61, wherein:
said step of causing comprises:
first moving said member from a first position at which said member is unable to engage a data cartridge magazine to a second position at which said member is able to engage a data cartridge magazine; and

second moving said member so that said member is oriented to engage a data cartridge magazine.

- [c66] 66. A method, as claimed in claim 65, wherein:
said step of first moving occurs before said step of second moving.
- [c67] 67. A method, as claimed in claim 65, wherein:
said step of first moving occurs after said step of second moving.
- [c68] 68. A method, as claimed in claim 65, wherein:
said steps of first moving and second moving occur during overlapping time periods.
- [c69] 69. A method, as claimed in claim 61, wherein:
said step of displacing terminates when a slot of said data cartridge magazine is sufficiently exposed for a cartridge transport to transport a data cartridge to or from said slot.
- [c70] 70. A method, as claimed in claim 61, wherein:
said step of displacing continues at least until there is substantially no association between said data cartridge magazine and said shelf.
- [c71] 71. A method, as claimed in claim 61, wherein:
said step of displacing comprises continues until substantially all of said data cartridge magazine is supported by said

support structure.

- [c72] 72. A method, as claimed in claim 71, further comprising:
moving, following said step of displacing, said support structure and said data cartridge magazine to a location adjacent to another shelf.
- [c73] 73. A method, as claimed in claim 72, further comprising:
transporting said data cartridge magazine from said support structure to said another shelf.
- [c74] 74. A method, as claimed in claim 73, wherein:
said another shelf is a movable shelf that is associated with an entry/exit port of the magazine-based data cartridge library.
- [c75] 75. A method, as claimed in claim 72, further comprising:
moving, following said step of displacing, said support structure and said data cartridge magazine to a location adjacent to a drive of the magazine-based data cartridge library.
- [c76] 76. A method, as claimed in claim 61, wherein:
said step of displacing comprises:
first displacing said member away from said shelf to displace a first point on said data cartridge magazine a first distance away from a second point on said shelf; and
second displacing, following said step first displacing, said member away from said shelf to displace said first point on

said data cartridge magazine a second distance away from said second point on said shelf that is greater than said first distance;
wherein said step of first displacing occurs over a first period of time;
wherein said step of second displacing occurs over a second period of time;
wherein said first period of time is separated from said second period of time by a third period of time.

[c77] 77. A method, as claimed in claim 76, further comprising:
third displacing, following said step of first displacing and before said step of second displacing, said member towards said shelf during said third period of time.

[c78] 78. A method, as claimed in claim 61, further comprising:
returning said data cartridge magazine to said shelf.

[c79] 79. With respect to a magazine-based data cartridge library having a first shelf and a second shelf that is separated from the first shelf by a space, and each shelf capable of holding a data cartridge magazine that has a plurality of slots with each slot capable of holding at least one data cartridge, a method for moving a data cartridge magazine between the first shelf and the second shelf comprising:
providing a member for engaging a data cartridge magazine;
providing a support structure for holding a data cartridge

magazine;
positioning said support structure adjacent to a data cartridge magazine that is associated with a first shelf;
first causing said member to engage the data cartridge magazine that is associated with said first shelf;
first displacing, following said step of first causing, said member away from said first shelf to move said data cartridge magazine so that said data cartridge magazine is not associated with said shelf and is associated with said support structure;
second displacing, following said step of first displacing, said member towards said second shelf to move said data cartridge magazine so that said data cartridge magazine is not associated with said support structure and is associated with said second shelf.

[c80] 80. A method, as claimed in claim 79, wherein:
said step of first causing comprises rotating said member.

[c81] 81. A method, as claimed in claim 79, wherein:
said step of first causing comprises linearly translating said member.

[c82] 82. A method, as claimed in claim 79, wherein:
said step of first displacing comprises:
causing a first movement of said data cartridge magazine to occur over a first period of time; and

causing a second movement of said data cartridge magazine to occur over a second period of time;
wherein said first period of time is separated from said second period of time by a third period of time.

[c83] 83. A method, as claimed in claim 79, wherein:
said step of first displacing comprises:
disengaging said member from said data cartridge magazine;
displacing, following said step of disengaging, said member relative to said data cartridge magazine; and
re-engaging said member with said data cartridge magazine.

[c84] 84. A method, as claimed in claim 79, wherein:
said step of second displacing comprises
causing a first movement of said data cartridge magazine to occur over a first period of time; and
causing a second movement of said data cartridge magazine to occur over a second period of time;
wherein said first period of time is separated from said second period of time by a third period of time.

[c85] 85. A method, as claimed in claim 79, wherein:
said step of second displacing comprises:
disengaging said member from said data cartridge magazine;
displacing, following said step of disengaging, said member relative to said data cartridge magazine; and
re-engaging said member with said data cartridge magazine.

- [c86] 86. A method, as claimed in claim 79, further comprising:
after said step of first displacing and before said step of
second displacing, moving said support structure and the data
cartridge magazine associated with said support structure
from a first location adjacent to said first shelf to a second
location adjacent to said second shelf.
- [c87] 87. A method, as claimed in claim 86, wherein:
said step moving comprises moving said support structure and
said data cartridge magazine associated with said support
structure in a direction with a horizontal component.
- [c88] 88. A method, as claimed in claim 86, wherein:
said step moving comprises moving said support structure and
said data cartridge magazine associated with said support
structure in a direction with a vertical component.
- [c89] 89. A method, as claimed in claim 86, wherein:
said step moving comprises moving said support structure and
said data cartridge magazine associated with said support
structure in a direction with both a horizontal component and a
vertical component.
- [c90] 90. A method, as claimed in claim 79, wherein:
said step of first displacing causing said data cartridge
magazine to move in a first direction; and
said step of second displacing causing said data cartridge

magazine to move in a second direction that is parallel to said first direction.

[c91] 91. A method, as claimed in claim 90, wherein:
said first direction and said second direction are oppositely directed.

[c92] 92. A method, as claimed in claim 90, wherein:
said first direction and said second direction are in the same direction.

[c93] 93. A method, as claimed in claim 79, wherein:
one of said first shelf and said second shelf is a movable shelf that is associated with a entry/exit port of the magazine-based data cartridge library.